FINAL
SAMPLING PLAN

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY

CHISMAN CREEK, VIRGINIA

W63237.00

SEPTEMBER 21, 1984

OPA COPY

WDR03/28

AR300155

CH2M HILL
engineers
planners
economists
scientists

September 24, 1984

W63237.00

Mr. Walt Graham
Remedial Site Project Officer
U.S. Environmental Protection Agency
Curtis Building
Sixth and Walnut
Philadelphia, Pennsylvania 19106

Dear Walt:

Subject: Work Assignment No. 83-3L37.0
Chisman Creek, Virginia, Superfund
Remedial Investigation/Feasibility Study
Final Sampling Plan

We are pleased to submit this final sampling plan for the Chisman Creek, Virginia, Remedial Investigation/Feasibility Study. This plan incorporates comments received at the April 23, 1984 public meeting and your comments as a result of your review to become familiar with the project.

If you have any questions or additional comments please call me at (703) 620-5200.

Sincerely,

Michael S. Thompson

Michael S. Thompson, P.E.
Site Project Officer

ps
cc: L. Boornasian/REM-DPO (EPA HQ) (2 copies)
R. Kaltreider/REM-DPO (EPA HQ) (2 copies)
R. Dagostaro/AZPM-REM/RPTL (WDC)
D. Shoup/Project Assistant (WDC)
W. Sellman/AZPM - Admin (WDC) (2 copies)
W. Wallace/QAM (SEA)
B. Davis/RPTL (DEN)
M. Jury/RPTL (GLO)
M. Kemp/RPTL (SFO)
S. Hoffman/RPTL (WDC)
B. Schilling/RPTL (SEA)
J. Howey/QA RVRS (WDC)
S. Guttenplan/QA RVRS (WDC)
J. Randall/QA RVRS (PDX)

Mid-Atlantic Regional Office
1941 Roland Clarke Place, Reston, Virginia 22091 703/620-5200

AR300156

CONTENTS

FIGURES

TABLES

WDR03/29

1.0 OBJECTIVES

This sampling plan describes the sampling procedures to be followed by CH2M HILL and CH2M HILL subconsultants during the Remedial Investigation of the Chisman Creek Hazardous Waste Site in York County, Virginia.

The results of previous field investigations (particularly the VIMS report), observations made during the initial site visit, and information obtained in discussions with those familiar with the site were used in preparing this sampling plan. Aspects of this plan may be changed as the field work progresses and more data become available.

2.0 STAFF ORGANIZATION, RESPONSIBILITIES, AND TRAINING

Figure 1 shows staff organization for the Chisman Creek RI/FS. Key CH2M HILL staff members include the Site Project Manager, Project Geohydrologist, Project Surface Water Specialist, Quality Assurance Manager, and Site Safety Officer. The responsibilities of these team members during field activities are described below.

2.1 SITE PROJECT MANAGER

The Site Project Manager (SPM) or his designee will coordinate field activities with the Remedial Site Project Officer (RSPO) and direct the activities of the CH2M HILL field team members and subconsultants.

2.2. PROJECT GEOHYDROLOGIST

The project geohydrologist (PG) will supervise the geophysical and well drilling subconsultants and will direct the sampling and logging of boreholes. The PG or his designee will also oversee the collection of groundwater samples, the performance of pump tests, and the measurement of water levels in wells.

2.3 SURFACE WATER SPECIALIST

The surface water specialist (SWS) will direct and supervise surface water and sediment sampling and surface water monitoring.

2.4 QUALITY ASSURANCE/QUALITY CONTROL MANAGER

The quality assurance/quality control manager (QAM) or his designee will be responsible for Quality Control and Quality Assurance activities as specified in the Quality Assurance Project Plan (QAPP). The QAM and quality assurance reviewers will review the work plan, QAPP, and sampling plan for technical soundness and consistency with guidelines.

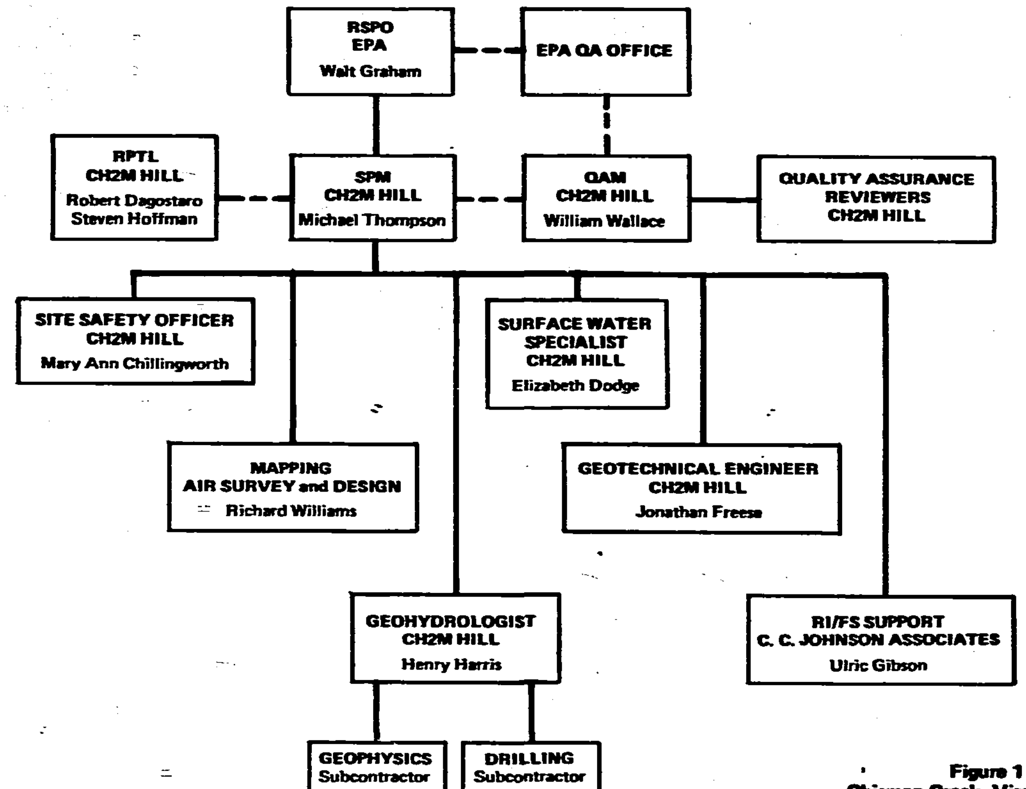


Figure 1
Chisman Creek, Virginia RI/FS
Project Organization

CH2M HILL

AR300161

Implementation of quality assurance guidelines in the field will be the responsibility of the SPM, PG, and SWS.

2.5 SITE SAFETY OFFICER

The site safety officer (SSO) will ensure that all members of the field team adhere to all site safety requirements specified in the Health and Safety Plan. Prior to the initiation of each field exercise, the safety officer or her designee will assist in briefings and will perform a final safety check. The SSO or her designee has the authority and responsibility to stop any operation that threatens the health or safety of the sampling team or surrounding populace.

2.6 TRAINING

Personnel involved in sampling on the site must have successfully completed the 40-hour Hazardous Waste Site Investigation Training (HWSIT) Course. These sampling personnel must also have successfully completed two other courses: the American Red Cross Multimedia Standard First Aid Course and the Basic Life Support Course in Cardiopulmonary Resuscitation. Personnel assigned to operate field equipment must be certified in the operation of that equipment.

Subconsultants hired for well drilling and geophysical investigations will complete the abbreviated (4-hour) HWSIT Course before working on the site.

Key field personnel will receive the Project Sampling Plan, the Site Safety Plan and the Project Work Plan in time to allow for review prior to field activities. Immediately preceding each sampling operation, a briefing will be held to review safety precautions and to perform a final safety check.

3.0 TYPES OF SAMPLES

As described in the Work Plan, four waste disposal areas have been identified for investigation. Areas A, B, C, and D (Figure 2) are former sand and gravel pits in which flyash from a nearby power station was disposed. Flyash was subsequently removed from Area D and replaced with demolition waste. Although it is not considered a part of the Chisman Creek site, the currently inactive York County Landfill, located immediately west of Area A, is a potential source of groundwater contamination and is included in this investigation.

Four types of samples will be collected:

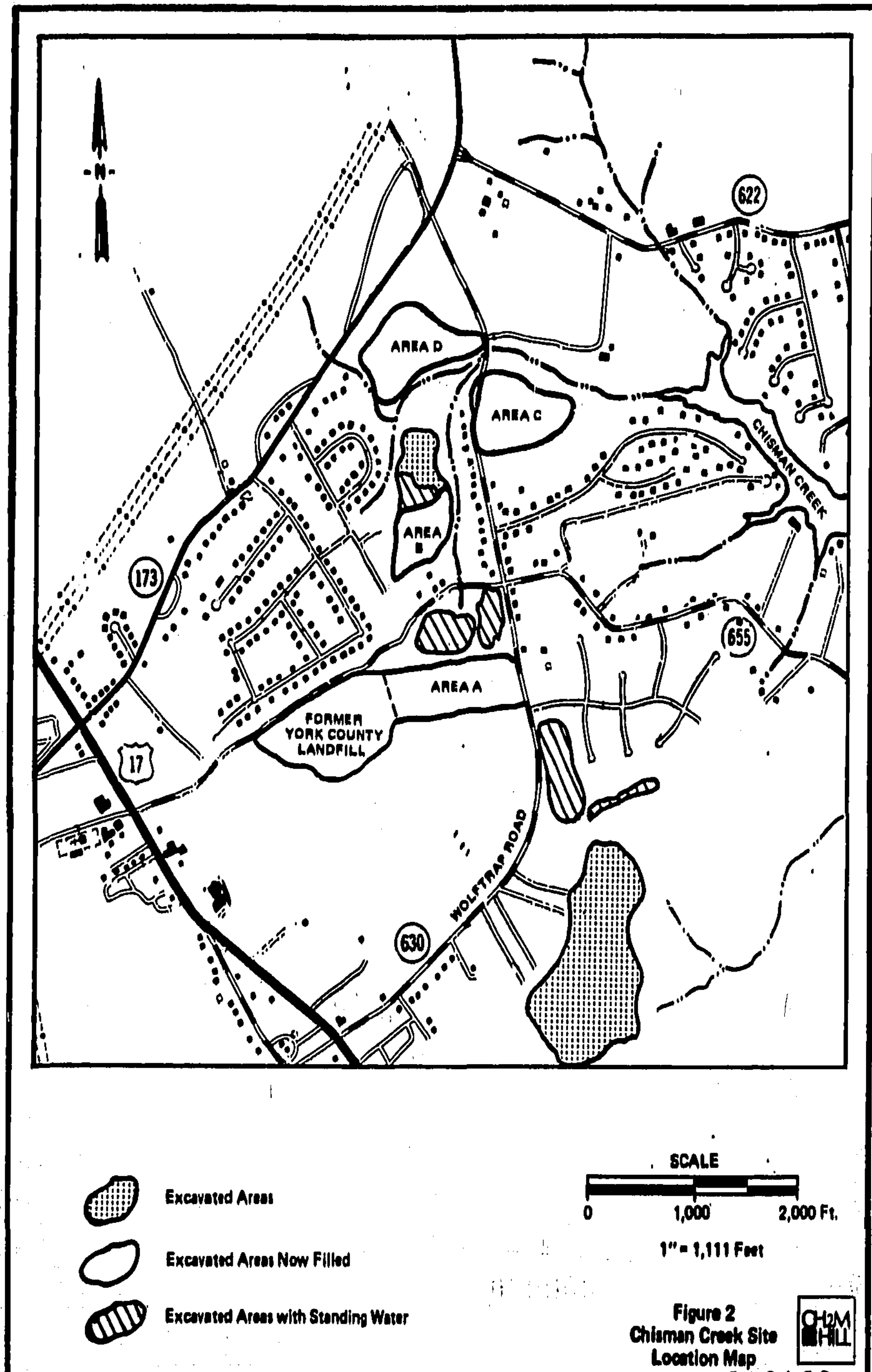


Figure 2
Chisman Creek Site
Location Map

AR300163

If the page filmed in this frame is not as readable or legible as this label, it is due to substandard color or condition of the original page.

- o Surface water from Chisman Creek and drainage channels tributary to it.
- o Sediment from the same locations as surface water samples.
- o Soil and/or flyash from borings on or near the four disposal areas.
- o Groundwater from monitoring and water supply wells.

The proposed locations of all samples and the procedures for sampling are described in the following sections.

4.0 SURFACE WATER AND SEDIMENT SAMPLING

4.1 SAMPLING LOCATIONS

Surface water samples will be collected from the eighteen stations shown on Figures 3 and 4. These stations were chosen to provide estimates of background contaminant levels, contaminant levels in areas closest to the disposal areas, contaminant levels in the estuarine part of Chisman Creek and the increase or attenuation of contaminants along Chisman Creek and its tributaries. Proposed sampling locations are:

- o Station 1 - upsteam of Route 173 and west of Area D in the northern fork of the unnamed ditch which enters Chisman Creek from the west. This station is intended to provide data on background contaminant levels in the drainage area and should be far enough upstream (west) of Route 173 to be free of contaminants frpm highway runoff.
- o Station 2 - in the middle fork of the above unnamed drainage ditch at the most upstream point at which a water sample can be obtained. Because this station may be influenced by groundwater inflows from Area B, it may not be a true background sample. It will, however, be a point for comparison with samples from farther downstream.
- o Station 3 - below the confluence of the north and middle forks of the drainage ditch and south of Area D.
- o Station 4 - the water-filled sand and gravel pit north of Area A, which drains into the south fork of the drainage ditch described above.

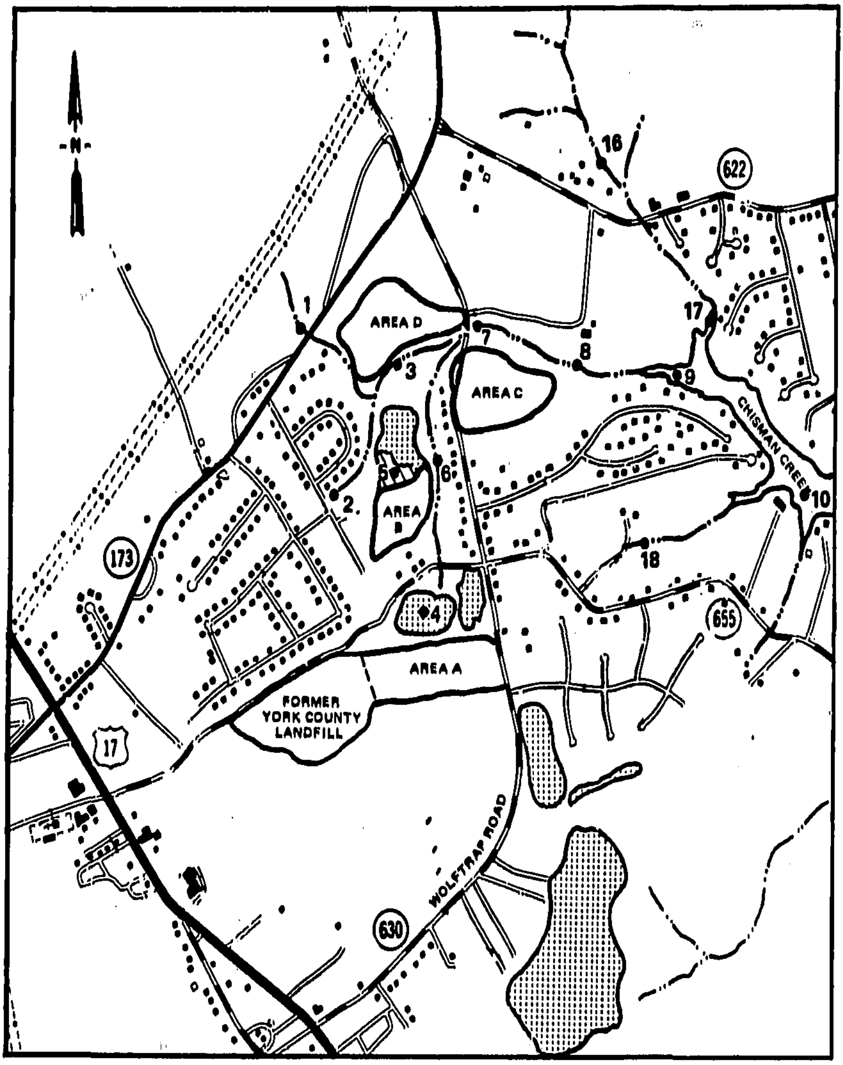
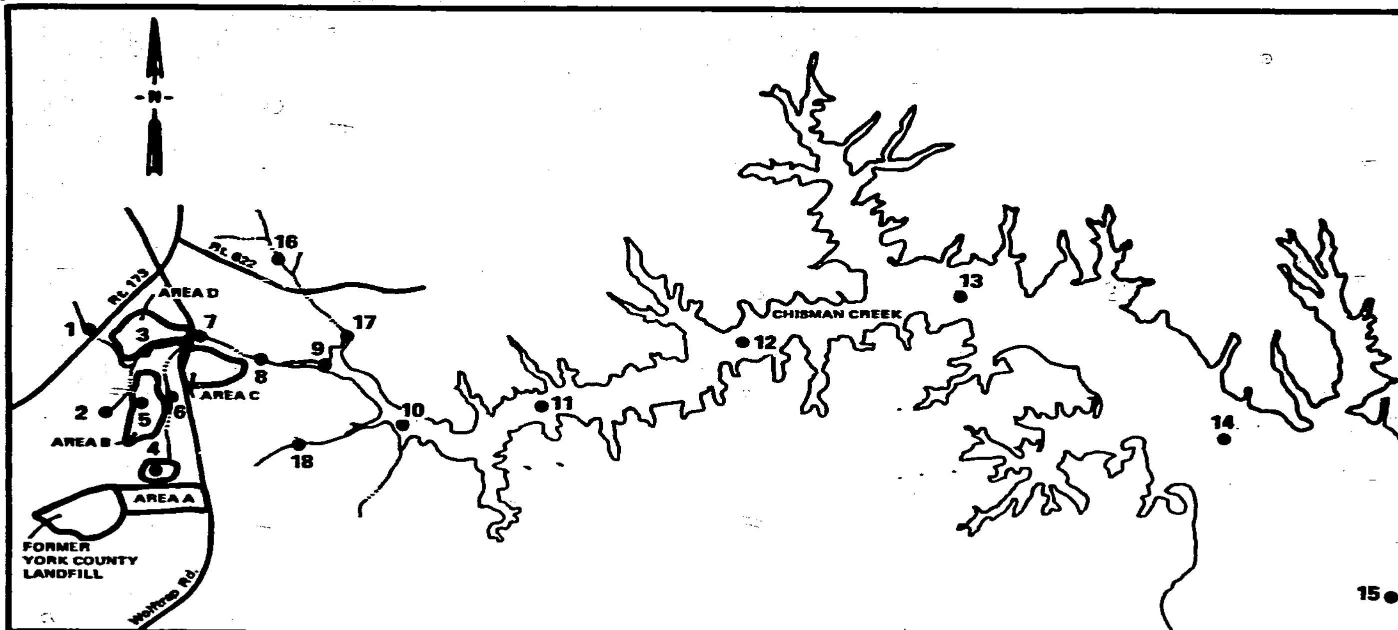


Figure 3
Surface Water and Sediment Sampling Stations

CH2M HILL

AR300165

If the page filmed in this frame is not as readable or legible as this label, it is due to substandard color or condition of the original page.



SCALE

1 0 1.5 1 Kilometer

Figure 4
Surface Water and Sediment Sampling Stations in Chisman Creek and Tributaries

CH2M HILL

AR300166

- Station 5 - the water-filled portion of the sand and gravel pit north of Area B. This area may be in direct contract with flyash in Area B.

- Station 6 - in the south fork of the drainage ditch northeast of Area B.

- Station 7 - north of Area C and east of Wolftrap Road, below the confluence of the forks of the drainage ditch described above.

- Station 8 - northeast of Area C, about midway between Wolftrap Road and the estuarine portion of Chisman Creek.

- Station 9 - in the upper estuarine portion of Chisman Creek.

- Station 10 - in Chisman Creek below the inflow from the Station 18 drainage channel.

- Station 11 - in estuarine Chisman Creek, about 4 miles upstream of the confluence with Chesapeake Bay.

- Station 12 - in estuarine Chisman Creek, about 3 miles upstream of the confluence with Chesapeake Bay.

- Station 13 - in estuarine Chisman Creek about 2 miles upstream of the confluence with Chesapeake Bay.

- Station 14 - in estuarine Chisman Creek about 1 mile upstream of the confluence with Chesapeake Bay.

- Station 15 - at the mouth of Chisman Creek.

- Station 16 - north of Route 622, in the drainage channel which enters Chisman Creek from the north. This station is in a relatively undeveloped area and is intended to provide information on background levels of contaminants in the watershed. This is considered useful because elevated concentrations of metals in surface runoff may be due not only to flyash from the four disposal areas but also to flyash present in construction materials.

- Station 17 - at the confluence of the north drainage channel and Chisman Creek Proper.

- Station 18 - north of Route 655 in a small drainage channel originating in Holly Hills; the channel may receive groundwater discharge from Areas A and B.

The exact locations of these sampling sites will be determined in the field after a complete walkover of the drainage channels has been made.

4.2 SURFACE WATER AND SEDIMENT SAMPLING PROCEDURES

4.2.1 Surface Water

The VIMS report concluded that runoff contributed significant concentrations of heavy metals to surface water. To confirm this, surface waters at the Chisman Creek site will be sampled twice, once immediately after a rainstorm and again during relatively dry weather. During both sampling episodes, unfiltered samples will be collected from all stations. Additional samples from stations 1, 6, 7, 9, and 10 will be filtered prior to preservation. Filtered and unfiltered samples will be analyzed for all priority pollutant metals, selected non-priority pollutant metals, major ions, total dissolved solids, and total suspended solids. Analyses included in this primary analytical protocol are listed in Table 1. To determine whether other pollutants are present at the Chisman Creek site, unfiltered samples collected from Stations 1 and 9 during dry weather will be analyzed for the parameters in Table 2, the extended analytical protocol for surface and groundwater. Table 2 lists, in addition to all the parameters mentioned above, priority pollutant volatile organics, base-neutral and acid extractable organics, and pesticides and PCBs.

Surface water samples from stations 1, 2, 3, 6, 7, 8, 16, and 18, where the water is relatively shallow, will be collected directly in the sample containers. Stations 4, 5, 9, 10, 11, 12, 13, 14, 15, and 17 which will be accessed by boat, will be sampled near the bottom with a Van Dorn or Kemmerer Sampler.

Sampling equipment will be decontaminated between stations by rinsing with methanol and potable water. One field blank and one duplicate sample will be obtained during each sampling episode.

The surface water sampling program is summarized in Table 3.

4.2.2 Sediment

Sediments will be sampled once, during dry weather conditions. Samples from Stations 1 and 9 will be analyzed for the parameters listed in Table 3, extended analytical

Table 1
PRIMARY ANALYTICAL PROTOCOL FOR SURFACE AND GROUNDWATER

Priority Pollutant Metals	Other Analyses
Antimony	Vanadium
Arsenic	Manganese
Beryllium	Iron
Cadmium	Aluminum
Chromium	Molybdenum
Copper	Barium
Lead	Calcium
Mercury	Magnesium
Nickel	Potassium
Selenium	Sodium
Silver	Chloride
Thallium	Sulfate
Zinc	Alkalinity
	Total Dissolved Solids
	Total Suspended Solids

WDR24/56

Table 2
EXTENDED ANALYTICAL PROTOCOL FOR SURFACE AND GROUNDWATER

PRIORITY POLLUTANTS

Volatile Organic Compounds (31)

Acrolein	1,3-Dichloropropene
Acrylonitrile	Ethylbenzene
Benzene	Methylene chloride
Carbon tetrachloride	Methyl chloride
Chlorobenzene	Methyl bromide
1,1-Dichloroethane	Bromoform
1,2-Dichloroethane	Trichlorofluoromethane
1,1,2-Trichloroethane	Dichlorodifluoromethane
1,1,2,2-Tetrachloroethane	Chlorodibromomethane
Chloroethane	Tetrachloroethylene
2-Chloroethyl vinyl ether	Toluene
Chloroform	Trichloroethylene
1,1-Dichloroethylene	Vinyl chloride
1,2-trans-Dichloroethylene	bis (Chloromethyl) ether
1,2-Dichloropropane	

Base-Neutral Extractable Organic Compounds (46)

Acenaphthene	Nitrobenzene
Benzidine	N-Nitrosodimethylamine
1,2,4-Trichlorobenzene	N-Nitrosodiphenylamine
Hexachlorobenzene	N-Nitrosodi-n-propylamine
Hexachloroethane	Butyl benzyl phthalate
bis (2-Chloroethyl) ether	Di-n-butyl phthalate
2-Chloronaphthalene	Di-n-octyl phthalate
1,2-Dichlorobenzene	Diethyl phthalate
1,3-Dichlorobenzene	Dimethyl phthalate
1,4-Dichlorobenzene	Benzo(a)anthracene
3,3'-Dichlorobenzidine	Benzo(a)pyrene
2,4-Dinitrotoluene	Benzo (b) fluoranthene
2,6-Dinitrotoluene	Benzo(k) fluoranthene
1,2-Diphenylhydrazine	Chrysene
Fluoranthene	Acenaphthylene
4-Chlorophenyl phenyl ether	Anthracene
4-Bromophenyl phenly ether	Benzo(g,h,i)perylene
bis (2-Chloroisopropyl) ether	Fluorene
bis (2-Chloroethoxy) methane	Phenanthrene
Hexachlorobutadiene	Dibenzo(a,h)anthracene
Hexachlorocyclopentadiene	Ideno(1,2,3-cd)pyrene
Isophorone	Pyrene
Naphthalene	
bis(2-Ethylhexyl)phthalate	

Table 2
EXTENDED ANALYTICAL PROTOCOL FOR SURFACE AND GROUNDWATER
(Continued)

Acid Extractable Organic Compounds (11)

2,4,6-Trichlorophenol	4-Nitrophenol
d-Chloro-m-cresol	2,4-Dinitrophenol
2-Chlorophenol	4,6-Dinitro-o-cresol
2-Nitrophenol	2,4-Dichlorophenol
Pentachlorophenol	Phenol
2,4-Dimethylphenol	

Pesticides and PCBs (26)

Aldrin	alpha-BHC
Dieldrin	beta-BHC
Chlordane	gamma-BHC
4,4'-DDT	omega-BHC
4,4'-DDE	PCB-1242
4,4'-DDD	PCB-1254
alpha-Endosulfan	PCB-1221
beta-Endosulfan	PCB-1232
Endosulfan sulfate	PCB-1248
Endrin	PCB-1260
Endrin aldeyde	PCB-1016
Heptachlor	Toxaphene
Heptachlor epoxide	2,3,7,8-Tetrachlorodibenzo p-dioxin (TCDD)

Metals (13)

Antimony (Sb)	Mercury (Hg)
Arsenic (As)	Nickel (Ni)
Beryllium (Be)	Selenium (Se)
Cadmium (Cd)	Silver (Ag)
Chromium (Cr)	Thallium (Tl)
Copper (Cu)	Zinc (Zn)
Lead (Pb)	

Miscellaneous (1)

Total Cyanides

Non-Priority Pollutants

Metals

Vanadium	Manganese
Iron	Aluminum
Molybdenum	Barium

Table 2
EXTENDED ANALYTICAL PROTOCOL FOR SURFACE AND GROUNDWATER
(Continued)

Calcium	Chloride
Magnesium	Sulfate
Potassium	Alkalinity
Sodium	

Total Suspended Solids
Total Dissolved Solids

WDR24/57

Table 3
EXTENDED ANALYTICAL PROTOCOL FOR SEDIMENT, SOILS, AND WASTE

PRIORITY POLLUTANTS

Volatile Organic Compounds (31)

Acrolein
Acrylonitrile
Benzene
Carbon tetrachloride
Chlorobenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
Chloroethane
2-Chloroethyl vinyl ether
Chloroform
1,1-Dichloroethylene
1,2-trans-Dichloroethylene
1,2-Dichloropropane
1,3-Dichloropropene
Ethylbenzene
Methylene chloride
Methyl chloride
Methyl bromide
Bromoform
Trichlorofluoromethane
Dichlorodifluoromethane
Chlorodibromomethane
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl chloride
bis (Chloromethyl) ether

Base-Neutral Extractable Organic Compounds (46)

Acenaphthene
Benzidine
1,2,4-Trichlorobenzene
Hexachlorobenzene
Hexachloroethane
bis (2-Chloroethyl) ether
2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,2-Diphenylhydrazine
Fluoranthene
4-Chlorophenyl phenyl ether
4-Bromophenyl phenly ether
bis (2-Chloroisopropyl) ether
bis (2-Chloroethoxy) methane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
bis(2-Ethylhexyl)phthalate
Nitrobenzene
N-Nitrosodimethylamine
N-Nitrosodiphenylamine
N-Nitrosodi-n-propylamine
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
Benzo(a)anthracene
Benzo(a)pyrene
Benzo (b) fluoranthene
Benzo(k) fluoranthene
Chrysene
Acenaphthylene
Anthracene
Benzo(g,h,i)perylene
Fluorene
Phenanthrene
Dibenzo(a,h)anthracene
Ideno(1,2,3-cd)pyrene
Pyrene

Table 3
EXTENDED ANALYTICAL PROTOCOL FOR SEDIMENT, SOILS, AND WASTE
(Continued)

Acid Extractable Organic Compounds (11)

2,4,6-Trichlorophenol	4-Nitrophenol
d-Chloro-m-cresol	2,4-Dinitrophencl
2-Chlorophenol	4,6-Dinitro-o-cresol
2-Nitrophenol	2,4-Dichlorophenol
Pentachlorophenol	Phenol
2,4-Dimethylphenol	

Pesticides and PCBs (26)

Aldrin	alpha-BHC
Dieldrin	beta-BHC
Chlordane	gamma-BHC
4,4'-DDT	omega-BHC
4,4'-DDE	PCB-1242
4,4'-DDD	PCB-1254
alpha-Endosulfan	PCB-1221
beta-Endosulfan	PCB-1232
Endosulfan sulfate	PCB-1248
Endrin	PCB-1260
Endrin aldeyde	PCB-1016
Heptachlor	Toxaphene
Heptachlor epoxide	2,3,7,8-Tetrachlorodibenzo p-dioxin (TCDD)

Metals (13)

Antimony (Sb)	Mercury (Hg)
Arsenic (As)	Nickel (Ni)
Beryllium (Be)	Selenium (Se)
Cadmium (Cd)	Silver (Ag)
Chromium (Cr)	Thallium (Tl)
Copper (Cu)	Zinc (Zn)
Lead (Pb)	

Miscellaneous (2)

Asbestos (fibrous)	total Cyanides

Non-Priority Pollutants

Metals

Vanadium	Manganese
Iron	Aluminum
Molybdenum	Barium

WDR24/74

protocol for sediment, soil, and waste. Samples from the remaining stations will be analyzed only for the metals listed in Table 4.

Sediment samples will be collected with a stainless steel scoop. At stations 1, 2, 3, 6, 7, 8, 16, 17, and 18, where water is relatively shallow, a shovel may be used to bring sediments to the surface. At stations 4, 5, 9, 10, 11, 12, 13, 14, and 15 where access will be by boat, sediment samples will be brought to the surface using an Eckman dredge.

Sampling equipment will be decontaminated between stations by rinsing with methanol and potable water. One duplicate sediment sample will be obtained.

The sediment sampling program is summarized in Table 5.

5.0 GEOPHYSICAL INVESTIGATIONS

Geophysical investigations will center on and around Areas A, B, C, and D. The exact locations of geophysical stations will be determined by the PG and the geophysical consultant, based upon examination of the topographic maps and upon field reconnaissance. Seismic soundings will be made on and adjacent to the four disposal areas to determine the thickness of the waste deposits, the depth to the Yorktown Formation, and the depth to the water table. Resistivity transects will also be made peripheral to the waste. Because groundwater contaminated with metals often shows elevated conductivities, these measurements may yield information on the extent of contamination peripheral to the flyash.

It is estimated that there will be at least ten seismic traverses (two mutually perpendicular traverses on each disposal area, two others in an undisturbed part of the site) and between 50 and 70 resistivity transects. The resistivity transects will consist of transects parallel or subparallel to the boundaries of each disposal area, followed by transects normal to these boundaries.

All geophysical investigations will be conducted prior to the initiation of drilling (Section 6.0). The results of the geophysical investigations will aid in establishing the location of boreholes.

6.0 SOIL, WASTE, AND GROUNDWATER SAMPLING

6.1 SAMPLING LOCATIONS

Soil and/or flyash samples will be collected during the drilling of 22 boreholes at 17 locations. Monitoring wells

Table 4
PRIMARY ANALYTICAL PROTOCOL FOR SEDIMENT, SOILS AND WASTE

Priority Pollutant Metals	Other Analyses
Antimony	Vanadium
Arsenic	Manganese
Beryllium	Iron
Cadmium	Aluminum
Chromium	Molybdenum
Copper	Barium
Lead	
Mercury	
Nickel	
Selenium	
Silver	
Thallium	
Zinc	

WDR24/55

Table 5
SURFACE WATER AND SEDIMENT SAMPLING PROGRAM

Station Number	Surface Water: Dry Weather Filtered	Surface Water: Dry Weather Unfiltered	Surface Water: Wet Weather Filtered	Surface Water: Wet Weather Unfiltered	Sediment (dry weather only)
1	0	0	X	X	0
2		X		X	X
3		X		X	X
4	0	0	0	0	0
5		X		X	X
6	X	X	X	X	X
7	X	X	X	X	X
8	0	0		X	0
9		X	X	X	X
10	0	0	0	0	X
11		X		X	X
12	X	X	X	X	X
13		X		X	X
14		X		X	X
15	X	X	X	X	X
16	0	0	0	0	0
17		0		0	0
18		X		X	X
Duplicate	1	1	1	1	1
Trip Blank		2		2	2
Equipment Blank		1		1	

X = primary analytical protocol (see Table 1)
0 = extended analytical protocol (see Table 2)

WDR24/53

will be installed in 20 of the boreholes to allow collection of groundwater samples. Approximate locations of these boreholes are indicated on Figure 5; the exact locations will be determined by the PG based on the results of topographic mapping, geophysical investigations and field reconnaissance. It is anticipated that boreholes will be finished both in the Tabb Formation (about 20 to 30 feet deep) and in the Yorktown Formation (about 50 to 70 feet deep).

The tentative locations of these borings and wells were chosen to provide information on background contamination of soils and groundwaters; on the ultimate (i.e., downgradient, lateral, and vertical) extent of any contamination; on the directions of groundwater flow (vertical and horizontal components); and on the thickness and character of individual waste deposits. Because there are at least three separate areas of waste deposition, one of which is adjacent to a sanitary landfill, wells and borings were also sited to provide some indication of the separate effects of each potential source of contamination.

Individual well and borehole locations are as follows:

- <u>Holes 1A and 1B</u> - deep and shallow wells upgradient (southwest) of the four disposal areas and the former York County Landfill. These wells should provide information on background contamination.

- <u>Hole 2</u> - a shallow well between the landfill and Area A, to determine what contaminants (if any) from the landfill are affecting groundwaters on the site.

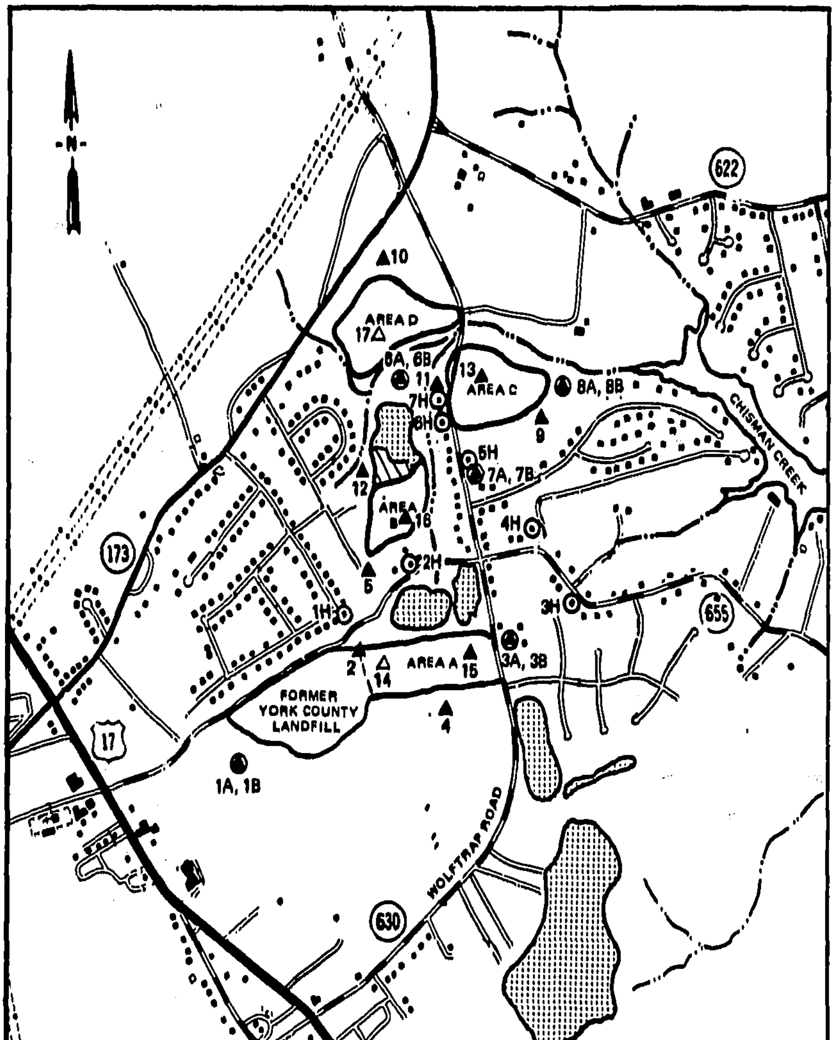
- <u>Holes 3A and 3B</u> - deep and shallow wells downgradient (east) of Area A and the landfill.

- <u>Hole 4</u> - a shallow well south of Area A to define the southerly extent of contamination.

- <u>Hole 5</u> - a shallow well upgradient (southwest) of Area B.

- <u>Hole 6A and 6B</u> - deep and shallow wells between Areas B, C, and D. These wells may intercept contaminants flowing from Area B northward toward the tributary of Chisman Creek. They may also allow distinction between the effects of Area B and those (if any) of Area D.

- <u>Holes 7A and 7B</u> - deep and shallow pump test wells south of Area C and east of Area B. These wells



LEGEND

- ▲ Borehole Location for Individual Monitoring Well
- Borehole Location for Paired Monitoring Wells
- △ Borehole Location Without Well Installation
- Borehole Location for Paired Pump Test Wells
- ⊙ Home Water - Supply Sampling Well

SCALE

0 1,000 2,000 Ft.

1" = 1,111 Feet

Figure 5
Approximate Locations of Boreholes, Groundwater Monitoring Wells, Pump Test Wells, and Home Water - Supply Wells

CH2M HILL

AR300179

are situated in a generally downgradient position, intermediate among the disposal areas. The intermediate position may allow use of these wells to characterize "average" hydraulic conductivities for the site as a whole. The downgradient position may allow future use of these two wells for synoptic (pump-test) sampling of a relatively large area.

- <u>Holes 8A and 8B</u> - deep and shallow wells <u>downgradient (east)</u> of Area C.
- <u>Hole 9</u> - shallow well southeast (potentially <u>downgradient</u>) of Area C.
- <u>Hole 10</u> - shallow well upgradient (north) of <u>Area D</u> to define the northerly extent of contamination.
- <u>Hole 11</u> - shallow well east of Area C, <u>downgradient</u> of Areas B and C. This well is situated in an area of probable groundwater contamination.
- <u>Hole 12</u> - shallow well west and potentially <u>downgradient</u> of Area B.
- <u>Hole 13</u> - shallow well in Area C. This and the <u>remaining</u> four holes will directly sample the disposal areas.
- <u>Hole 14</u> - borehole in Area A.
- <u>Hole 15</u> - shallow well in Area A.
- <u>Hole 16</u> - shallow well in Area B.
- <u>Hole 17</u> - borehole in Area D.

6.2 DRILLING AND SOIL SAMPLING PROCEDURES

All drill rigs will be thoroughly cleaned prior to use on the site. All water used in drilling and cleaning will be potable water. Augers, casing, rods, bits, and samplers will be steam-cleaned, rinsed with a 20 percent solution of methanol and water, and rinsed with potable water before and after use at each location. Samplers will be washed with a TSP solution, rinsed with a 20 percent solution of methanol and water, and rinsed with potable water between each sample.

In the Tabb Formation and in waste deposits, boreholes will be advanced as deep as practicable with hollow-stem augers.

Borings requiring penetration beyond the useful range of these augers will be advanced using casing and air rotary or wet rotary techniques. If wet rotary techniques are employed, drilling water will be obtained from a public potable water supply, and a sample of drilling water will be taken for chemical analysis both before and after drilling.

Boreholes penetrating the Yorktown Formation will be advanced by rotary methods in casing to prevent vertical transfer of contaminants during drilling and maximize the possibility of obtaining representative groundwater and soil samples. Borings in the waste disposal areas will not be advanced more than two feet beyond the base of the waste deposits.

Samples of soil will be recovered from boreholes using a standard (eighteen-inch) split-spoon sampler (ASTM D1586). Boreholes through flyash deposits will be continuously sampled. Samples will be recovered at 5-foot intervals and at formation boundaries at boreholes outside of the flyash deposits. A geologic log will be recorded at each hole. The logs will describe the texture, strength, structure, color, and mineralogy of materials penetrated as well as depth to the water table.

Samples from up to twenty of the split spoons will be selected for chemical analysis. These samples will include:

- Samples from the Tabb and Yorktown Formations at Hole 1, the background location,
- Samples from the Tabb and Yorktown Formations at Hole 8, downgradient of the disposal areas, and
- Samples from the upper third of, lower third of, and materials just beneath the flyash deposits at Holes 13, 14, 15, 16, and 17.

Based on observations made during drilling, additional samples may be selected for analysis at the discretion of the PG. In some instances, composite samples may be submitted to reduce the number and cost of analyses. Most split-spoon samples will be analyzed for the parameters listed in Table 4. Samples from Holes 1, 8, 16, and 17 will be tested for contaminants in the extended protocol given in Table 5.

6.3 WELL INSTALLATION AND GROUNDWATER SAMPLING PROCEDURES

Monitoring wells will be installed in 20 of the boreholes. Wells will be fabricated of sections of PVC pipe with factory-slotted screens. All couplings between sections of pipe will be threaded and will be wrapped with Teflon tape prior to joining. The bottom section of each well will be fitted with a PVC plug. Monitoring wells used for pump tests will be constructed with 4-inch ID, schedule 80 PVC well screens and standpipes. Other monitoring wells will be constructed with 2-inch ID, schedule 40 PVC well screens and standpipes.

The annulus between the well screen and the wall of the borehole will be packed with sand, a sample of which will be taken and included with sediment samples provided to US EPA. Bentonite seals will be placed in the annulus just above the screened and packed section. Seals will be emplaced using either bentonite pellets or a slurry of powered bentonite and water. A sample of bentonite will also be taken and provided to US EPA. Parts of the annulus not filled with bentonite or sand pack will be backfilled with natural sediments or with expanding cement grout, at the discretion of the PG.

All finished wells will be protected with a 5-foot length of steel pipe cemented into the ground. Protector pipes at all locations will have a locking cap, lock, and identification tag. Keys to the locks will be provided to US EPA. Elevations of all wells will be determined by a professional land surveyor registered with the State of Virginia. The distance between the lip of the protector pipe and the top of the PVC casing will also be measured at each well.

Wells will be developed immediately after installation by alternately and repeatedly pumping water into and then out of the well, until water removed from the well is free of sediment. Development will be finished by pumping water from the well.

Groundwater samples will be collected from all 20 monitoring wells no sooner than one week after development of the wells. Groundwater samples will also be taken from about seven residential wells. The tentative locations for residential well samples are shown on Figure 4. The exact locations will be identified based on the residential well survey, Task 3 of the work plan. All groundwater sampling will occur in conjunction with the dry weather sampling of surface waters (Section 4.2.1).

All monitoring wells and selected private wells will be sampled and analyzed once. The sampling procedure at monitoring wells will consist of, in order: 1) measurement of water level in the well, 2) measurement of water temperature at the midpoint of the well screen, 3) in productive wells, purging of the well by pumping, with simultaneous measurement of the pH, Eh, conductivity, and temperature of the purged water, 4) in less productive wells, purging by bailing, with measurement of the pH, conductivity, and temperature of the final sample, 5) collection of the sample with a PVC bailer dedicated to the well, and 6) cleaning of those parts of the down-hole measurement and sampling equipment (other than the dedicated bailer) that have come in contact with well water.

Productive monitoring wells will be purged with a submersible pump with a capacity ranging from 0.5 to 1.5 gallons per minute. The intake of the pump will be lowered to within a few inches of the bottom of the well and purged water passed directly from the discharge tubing of the pump into a chamber in which field parameters (pH, conductivity, temperature) are measured before the water contacts the atmosphere. Samples will be taken when the field parameters remain stable (±10 percent) over at least three "well volumes" of purged water (a "well volume" being the volume of water contained in the well at the onset of pumping). Less productive wells (those without sufficient flow for continuous pumping) will be bailed dry and allowed to refill prior to sample collection.

The sampling procedure for residential wells will be like that for the productive monitoring wells, except that samples will be taken directly from the installed plumbing. Samples will be taken as close to the pump as possible.

All groundwater samples will be analyzed for the parameters given in Table 1. Samples from Well 1A (the shallow background well), 6A (the shallow well between areas B, C, and D), and Well 8A (the shallow well downgradient of Area C) will be analyzed for all of the parameters given in Table 2. Splits of four of the Table 1 samples and one of the Table 2 samples will be filtered (0.45 micron paper) in the field prior to preservation and submitted for analysis along with the unfiltered half. Three duplicate samples and two equipment blank samples will also be taken and submitted for analysis.

All equipment that contacts groundwater will be cleaned immediately after each use. Cables and tubing will be wiped with a disposable towel soaked in methanol as they are withdrawn from the well. All equipment, including cables and tubing, will be rinsed with a 20 percent solution of methanol and water and then with water after removal from the well. Finally, at least two gallons of a detergent (TSP) solution, followed by a two gallons of a dilute solution of methanol and water, will be pumped through the submersible pump and discharge tubing.

7.0 DOCUMENTATION

The purpose of the document control program is to ensure that all field data collected at the Chisman Creek site can be accounted for upon completion of the project. Additionally, documentation procedures ensure the accuracy, usefulness, and retrievability of the information gathered during the sampling operations.

7.1 SITE LOCATIONS

All surface water and sediment sampling sites and all geophysical survey stations will be located in the field by CH2M HILL personnel. Sampling locations and important survey stations will be identified by stakes or buoys. Stakes (approximately 2" x 2" x 24") will be driven into the ground, allowing approximately 8 to 10 inches of the stake to remain visible above ground. The top portion of each stake will be painted orange and labeled with an identification number. Buoys anchored with a weighted line will be used to identify sampling locations in deeper waters. The sample location and type will be entered in a field notebook, together with a site sketch and general description. Groundwater monitoring wells will be located by survey following installation.

7.2 PHOTOGRAPHS

Photographs of each surface water and sediment sampling site will be taken and logged in a field notebook. Each entry will include: the project, time, date, and location of the photograph; a complete description of objects in the photograph; the film roll and frame number; and the person taking the photograph. The film roll number will be identified by taking a photograph of an information sign on the first frame of the roll.

For example:

Chisman Creek
Roll No. 1
Frame No. 1 of 36
February 1, 1984--John Doe

Additional photographs will be taken showing typical procedures for drilling, soil sampling, well installation, surface sediment sampling, surface water collection, groundwater collection, and geophysical investigations.

7.3 FIELD NOTEBOOKS

Field notebooks will be used for recording activities performed at a site. The notebooks will be bound field survey books. Entries will include sufficient detail to reconstruct significant activities without reliance on memory. All measurements and samples collected will be noted.

Individual notebooks will be assigned to the SSO and the person in charge of each sampling team. Field notebooks will remain in the custody of the assignee during sampling activities. Each notebook will be identified by the project-specific document number. The cover of each notebook will contain:

- o Person or organization to whom the book is assigned
- o Book number
- o Project name
- o Start date
- o End date

Whenever a sample is collected or a measurement made, a detailed description of the sample location will be recorded. Incorrect information will be crossed out with a single strike mark and initialed.

The equipment used to collect samples will be noted, along with the sampling time, sample description, sample depth and volume, and number of containers. In addition, the number of the cooler into which the sample is placed in the field will be recorded.

7.4 SAMPLE LABELING, CONTROL, AND PRESERVATION

All samples will be labeled first in the field using a CH2M HILL numbering and coding system. The samples will then be tagged with EPA sample tags and logged on chain-of-custody and SMO traffic report forms.

All sample containers will be labeled immediately after they are filled at the sampling site. The sample label will show the date, time of sampling, sampler's initials, and sample number. The label will be filled out with ball-point or indelible felt-tip pen. The label is for field use only; it does not replace the standard tags used for the CLP.

No detailed sample "code" will be developed before the field program. Rather, each sample will be described in plain language; for example:

"Groundwater"
"Surface Water"
"Soil"
"Sediment"
"Waste"

Each sample of the above will be numbered from 001 to the maximum collected of its type, and listed on the Master Sample Log for the project. This log will be maintained by the SPM or his designee.

This numbering scheme has the effect of minimizing extraneous information transmitted to the CLP, and thereby maximizing security of identification of the blank and duplicate samples.

EPA serialized sample tags will be used to label each sample for analysis. The tag has a place for designating the sample as a grab or a composite, identifying the type of sample collected, and indicating the preservative, if any. Tags are attached to or folded around each sample container, and are taped in place.

Chain-of-custody records will be completed for all samples according the EPA requirements and CH2M HILL procedures set forth in the CH2M HILL REM/FIT Quality Assurance Guidance Manual. Custody seals will be placed on all coolers containing samples, and on sample bottles, if required.

Required sample containers and filling instructions are summarized in Table 6.

The collected sample containers will be kept out of direct sunlight and, after decontamination and labeling, will be placed in coolers and stored on ice until they are packaged for shipping to the Contract Laboratory. Samples for the CLP will be shipped via overnight delivery service within 48 hours.

8.0 SITE CLEANUP

Investigation-derived wastes that will be generated during the Chisman Creek RI include drill cuttings, purge water from well development, wash water from decontamination, and soiled disposal booties, gloves, and tyvek suits. Because the levels of contamination at the site are expected to be low ($\leq$10 ppm) most investigation-derived wastes will be left on the site. Drill cuttings will be disposed of on the site. Purge water and wash water be discharged onto the ground at the site. Soiled disposable clothing will be placed in plastic bags and disposed of offsite.

WDR03/25

Table 6
SAMPLE CONTAINERS AND PRESERVATIVES

Parameter	Container Type	No. of Containers per Sample	Preservative
pH, conductivity, alkalinity, sulfate, chloride	1-liter plastic[1]	1	None
Ca, Mg, Na, K	1-liter glass[1]	2	HNO_3, pH $\leq$ 2
Other Metals	1-liter glass[1]	2	HNO_3, pH $\leq$ 2
Volatile Organics (VOA)	40 ml glass vial with teflon septum cap	2	4 drops HCl in one vial; No preservative in other vial
Base/Neutrals and Acid Extractable Organics; Pesticides/PCBs	1/2 gallon amber glass[2]	2	None
Soil/Sediments	1 quart wide mouth glass jar[2] (fill jar 3/4 full)	1	None

NOTE: [1]Plastic cap is acceptable.
[2]Teflon insert in cap required.
HNO_3 is concentrated reagent grade.
Zinc acetate is ZN.

WDR24/90